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FIDO: Enabling Mars 2003 and 2005 Rover Science Operations

Albert F. C. Haldemann¹ (albert@shannon.jpl.nasa.gov)
Paul Backes¹, Eric T. Baumgartner¹, Diana L. Blaney¹, Leonard I. Dorsky¹, Randal A. Lindemann¹, Paul S. Schenker¹, Raymond E. Arvidson², Steven W. Squyres³, Gostar Klingelhofer⁴

¹Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA 91109-8099

²Dept Earth and Planetary Sciences, Washington University, St. Louis, MO 63130

³Dept Astronomy, Cornell University, Ithaca, NY 14853

⁴Institute for Inorganic and Analytical Chemistry, University Mainz, Mainz D-55099, Germany

The Field Integrated Design Operations (FIDO) rover, developed by the Jet Propulsion Laboratory (JPL) is an operations testing prototype (<http://robotics.jpl.nasa.gov/tasks/etrover/homepage.html>) of the 2003 and 2005 Mars Sample Return rovers and their associated Athena payload (<http://fidoinstruments.jpl.nasa.gov>, <http://athena.cornell.edu>). FIDO simulates complex, remote rover surface operations in Mars analog settings. The operations scenarios require: (a) finding, characterizing, obtaining, caching, and returning samples to the ascent vehicles on the 2003 and 2005 landers, and (b) continuing to explore and making observations after sample delivery. To accomplish these tasks FIDO is equipped with a 1.94 m mast housing: (a) Pancam a false color infrared stereo imaging system capable of surveying the terrain at high spatial resolution for scientific purposes; (b) Navcam, used for planning traverses, with low spatial resolution, wide field of view and a broader stereo baseline than Pancam; and (c) Infrared Point Spectrometer (IPS), bore-sighted with these instruments, acquiring spectral radiance information over the wavelengths from 1.3 to 2.5 micrometers with 13 cm⁻¹ resolution. IPS can be used both in a point mode and a mode in which a suite or raster of data are acquired to form an image cube. With targets identified within these observational data, FIDO is commanded to get to them (with use of hazard avoidance systems). Upon arrival an arm is placed onto the relevant surfaces for color microscopic imaging. A drilling system can then acquire a 0.5 cm diameter by up to 1.7 cm long rock core. The core is extracted and examined with the microscope imager to ensure its integrity. Marsbauer spectroscopic observations of the same samples require overnight runs. The first major field test took place in the Silver Lake area, Mojave Desert for two weeks in April 1999 with follow-up work in October 1999 with updated IPS optics (<http://wufs.wustledu/rover/>). The field test rover observations are placed in the context of satellite and airborne remote (Advanced Hyperspectral Imager, AHI) sensing data. AHI shows calcite and dolomite distribution at the Silver Lake site, which are compared with the IPS observations on the ground. With lab Raman Spectroscopy carried out on hand samples, the field test dataset covers scales from a few meters to a few microns. Additional operations tests to optimize data acquisition versus command cycles are conducted in JPL's Mars Yard test facility.

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3. (a) Albert F. C. Haldemann
Jet Propulsion Laboratory,
California Institute of
Technology, 4800 Oak Grove
Dr.
Pasadena, CA 91109-8099
(b)
(c)
(d) albert@shannon.jpl.nasa.gov
4. P
5. (a)
(b) 5194, 5464, 5494, 6225
(c)
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